

Pending nominations 885 to 888, and new nomination 889 were read.

Mr. Fraley reported the receipt of \$131.81, being the last quarterly interest on the Michaux Legacy fund, due Oct. 1.

And the meeting was adjourned.

Stated Meeting, December 5, 1879.

Present, 13 members.

Vice-President, Mr. FRALEY, in the Chair.

A letter enclosing a photograph for insertion in the album was received from Prof. Richard Akerman, dated Stockholm, Nov. 13, 1879.

An acknowledgment of the receipt of Proc. No. 103, was received from Professor J. J. Stevenson, dated New York, Nov. 28.

A letter of envoy was received from the Central Physical Observatory at St. Petersburg, dated Oct. 1879.

A letter was received from the Cleveland Library Association requesting exchanges.

Donations for the Library were received from the Senkenburg Society of Natural Sciences; Revue Politique; Commercial Geographical Society, Bordeaux; London Nature; Geological Survey of Canada; Boston Society of Natural History; Yale College; Mr. Redfield, of Philadelphia; the Botanical Gazette; North American Entomologist; and the Ministerio de Fomento, Mexico.

The death of M. Michel Chevalier, at Paris, Nov. 28, aged 73, was announced by the Secretary.

Mr. Moncure Robinson was appointed to prepare an obituary notice of the deceased.

Mr. Lesley exhibited a slab of roofing slate covered with casts of *Buthotrephis flexuosa*, obtained by Prof. Frazer for the Museum of the Second Geological Survey of Pennsylvania, from the Rev. Prof. Rendall, of Lincoln University,

who obtained it (with several others) from a miner in the Peach Bottom slate quarries on the Susquehanna river near the Maryland State Line. The other slabs are in the York Museum, in York County, Pennsylvania. The species of fucoid was determined by Prof. Lesquereux from a careful drawing, which he pronounced sufficiently characteristic.

The great importance of this discovery in confirming the long suggested possible existence of Hudson river slates (Lower Silurian, No. 111) so metamorphosed as to be almost totally destitute of organic remains, in the so-called sub-palæozoic, hypozoic, hypazoic, azoic, or eozoic (Huronian, Cambrian, or Laurentian) belt of the Atlantic sea coast, was dilated upon and discussed by Prof. Lesley, Prof. Frazer, Prof. Cope, and Prof. Hayden. Mr. Lesley said:

Prof. Lesquereux has just determined *Buthotrephis flexuosa* on a slab of roofing slate from the quarries on the Susquehanna river near the Maryland line. This is a most important discovery. Prof. Frazer has been studying the roofing slate belt and adjoining chlorites for several years in connection with his York and Lancaster county work. He never found any traces of organic life, nor could hear of any. But he found several curious forms in the rocks across the State line in Maryland, one of which looked like a flattened *Orthoceras*. Prof. James Hall and Mr. Whitfield were disposed to consider them not organic. They have been figured for the American Philosophical Society's Proceedings and for the Reports of the Survey. These are the only fossils ever seen in that region to our knowledge. The slab of *B. flexuosa*, is in our Museum and will be figured. Prof. Frazer received it from a Presbyterian clergyman, President I. N. Rendall of Lincoln University, who got it from a miner, as part of a mass four or five times as large, the remainder of which he sent to the York Museum, York, Penna., in acknowledgment of aid from the citizens to the university. There seems to be no doubt that the slabs came from the Peach Bottom quarries as asserted.

There are two species of *Buthotrephis* known, one in the Trenton, three in the Hudson river slates, one in the Clinton. One is reported from the Devonian of Russia. Several from the Subcarboniferous remain unstudied. *B. flexuosa* is characteristic of the Hudson river. It is in the upper part of the Hudson river formation, along the foot of the Kittatiny or Blue or North Mountain, on the Lehigh river, in eastern Pennsylvania, that we have our Slatington and other roofing slate quarries; and no trap is known in the neighborhood, and no reason can be assigned for excessive metamorphosis of structure (not of lithology); but on the Maryland line, a trap dyke many miles long has been followed by Prof. Frazer, across Lancaster

county, from the Peach Bottom roofing slate belt *through the Gap Nickel mine*, north-eastward into the Welsh mountains. But, as the roofing slate belt is several miles long, I can see no important connection between the trap at one end of it and its metamorphism.

Prof. Frazer feels sure that the roofing slates are part and parcel of the chlorite slate formation which makes such a show along the river for miles north of the quarries. But the structure is very obscure. To the north of the (south dipping) chlorites, a bold, double-crested anticlinal (of Tocquan creek) crosses Lancaster and York county, and is finely exposed upon the two banks of the Susquehanna river, bringing up massive gneisses, &c., evidently referable to our Philadelphia gneisses, to those of the Welsh mountains west of the Schuylkill river, and to those of the Highlands of New Jersey and New York states. The chlorite slates are always seen in this region in juxtaposition with limestones which we feel confident are No. II ("Magnesian" "Calcareous"); but the structural connection is not yet quite satisfactory. Mr. C. E. Hall is disposed to look upon them all along the Chester county "south valley hill," and across the Schuylkill into Philadelphia, and towards Trenton, as No. III (Hudson river) metamorphosed.

Everything points towards nonconformable basins or outlying patches of metamorphosed Silurians in the heart of our Azoic country of southern Pennsylvania and Maryland, and this discovery of *B. flexuosa* leaves very narrow room for further doubt on the subject.

Prof. Frazer gave a partly detailed description of the section along the Susquehanna,—an analysis of the difficulties he encountered in making out its true structure,—and the doubts which still hang over the relationship of the roofing slate belt to the chloritic, mica slate and gneissoid areas, on each side of the great Tocquan anticlinal.

Prof. Frazer said that in reference to the effect of the determination of the Peach Bottom slates as of Hudson river age, a word of explanation would make its extent clear.

The Susquehanna section was prepared carefully foot by foot with a perfectly accurate 200 ft. = 1 inch R. R. plotting in the hand. The exact position of every station (the stations were all 100 feet apart) and the outline of the shore and curves in the road were given on the plot, while the inner side of the outer rail was painted with the number corresponding to each station. Locations were therefore almost perfectly accurate. From Columbia to Turkey hill (\pm 5 miles south) was filled with limestone. Chlorite slates come in abruptly at Turkey hill, and last along the shore (still going south) to within a mile or so of Safe Harbor, when

they gradually alter to mica schist, and beyond Safe Harbor to true gneiss. This lasts for about eleven miles, with its dips about evenly divided by the Tocquan creek, the northern portion dipping gently N. W. and the southern portion S. E. Whatever be the age of the chlorite series therefore, and whatever be the age of the Tocquan rocks, the latter interpose a limit to the extent to which a change of horizon of the former may affect the structure. The Tocquan anticlinal is too broad and flat and extensive, not to mention its strongly marked lithological characteristics, to be anything else than what it seems. Nobody can invert either of its limbs. It is a Safe Harbor to the bewildered stratigrapher; and a Mount Ararat to the ark of the propounder of theories. This welcome element of structure, however, fades out into inconclusive and rare exposures near Fishing creek, after which the chlorite series begins to appear, and continues, with numerous exposures, to a point a little less than half a mile north of Peters creek, quartz entering largely into the composition of the rocks which are otherwise highly convoluted, green and unctuous. Here come in the Peach Bottom slates with but little time for transition, and pass, after a breadth of a few hundred yards, equally abruptly, into chlorites again, and finally into a greenish chloritic quartzite, which is the northern boundary of Peters creek (when in flood). This greenish quartzite puzzled the speaker so much that in his report written two years ago, but not issued, he deemed the matter important enough to present two views of its age. He says, page 135, "The structure supposed in the section will not assign to this rock contemporaneity with the Chikis quartzite, nor form a continuity with the quartzites to be noted further down the river" (which are ascribed to Potsdam age). "But the interpretation of the stratigraphy here is of the greatest difficulty," &c., &c. Again, page 141, another structure than that adopted is given which makes "the hydromica schists in the basin of the first synclinal the lower limestone slates or hydro mica schists." Not because of any lithological considerations, however, but solely on the hypothesis that the column of formations appear in their normal order, which needs to be established.

In other words, if the Peach Bottom slates be established as of Hudson river age, the real difficulty would seem not be a stratigraphical one; for they might be supposed to be deposited unconformably on any of the older series, without the intervening members of the column. But the only difficulty—not an insurmountable one perhaps—will be to account for the alteration of the argillaceous strata characteristic of that horizon, to the highly crystalline magnesia hydromicas which remind one so much of what the speaker asks permission still to regard as the *true chlorites*—the chlorites of the South Mountain.

It is interesting in this connection, to call attention to the analysis of these Peach Bottom slates, made at my request by Mr. A. S. McCreath, at Harrisburg.

The specimen is from J. Humphrey & Co.'s Quarry, half a mile east of Delta, York county.

Silicic Oxide (SiO_2).....	55.880
Titanic Oxide (TiO_2).....	1.270
Sulphuric Oxide (SO_3).....	0.022
Alumina (Al_2O_3).....	21.849
Ferrous Oxide (FeO).....	9.033
Manganous Oxide (MnO).....	0.586
Cobaltous Oxide (CoO)....	trace
Lime (CaO).....	0.155
Magnesia (MgO).....	1.495
Soda (Na_2O).....	0.460
Potash (K_2O).....	3.640
* Carbon (C).....	1.794
Water (H_2O).....	3.385
Iron Bisulphide (FeS_2).....	0.651
Total.....	99.800

Mr. McCreath added a note which is not at hand, but to the effect that he believed this 1.794 p. c. of carbon (so common an ingredient in Hudson river rocks) was not in the form of graphite.

Carbon might be looked for lower as well as higher than the horizon assigned to the chlorite series, but, if the former, it would be more likely to appear as graphite.

The following extracts from a letter of President Rendall to Professor Frazer, in answer to further inquiries as to the genuineness of the fossil, are of importance in view of the length of time which may possibly elapse before another specimen is brought to light.

In 1875, I visited the quarries in company with Dr. S. B. Howell of Philadelphia. I am not certain whether he obtained a specimen at that time. I think he did of the rock but not of the fossil. I went from quarry to quarry inquiring of the old workmen and of the owners, whether they had at any time seen any marks on the slate. The answer for the most part was no; but two of the more experienced workmen said they had noticed some marks, but they had a vague notion of them, and could not give an adequate description. They thought they had seen them recently, and searched some piles of slate without success.

I left an order with them to preserve for me any specimens which might turn up. They promised in a friendly way to keep whatever might be found. There was no promise of money. They did not expect reward, and had no reason to procure specimens to deceive, unless for the pleasure of deceiving. They were to notify the resident Pres. minister who promised to take possession for me. In a little while they sent word to him that they had found some marks on a slab. He omitted to go for it, or to notify me,

* Average of three determinations.

and after keeping it for some time, they threw it out among the rubbish. In 1876 (in the fall), I was on the ridge myself, and went to each of the quarries, and learned what I have just written ; and at one of the quarries the superintendent said they had found a few days before a slab with some marks on it, and had thought of me, but not seeing that the marks were indicative of anything especially interesting, they had thrown it away over the edge of the rubbish pile. The superintendent called three or four workmen, and directed them to search for the block which he said could not be buried very deep.

We threw the top pieces over, rolling them further down, and in perhaps half an hour came upon the piece they were looking for, and with it the piece which is in your possession. All the indices are in favor of its origin in the quarry at Peach Bottom. There was the first report that certain marks had been seen, but that they were rare. The workmen were not in the habit of finding and holding for sale specimens of the rock. These specimens were not regarded as interesting or valuable, but were thrown away, and only recovered as I have said. The block I speak of must have weighed, as I saw it, not less than seventy-five pounds.

The State geologist has the opportunity of identifying the slate on which the stems of the fucoid are with the slate of Peach Bottom, or of some other locality. Until some evidence is obtained that ends all doubt, this would be a confirmatory mark. The slate at Peach Bottom is not identical with the Lehigh slate. But I have no doubt the evidence on the spot can be made sufficient. The fossil is rare. Any one might have to wait there a long time to see one. I do not know the name of the men, who found the piece for me, but I can get them by correspondence.

Prof. Cope presented a communication entitled, "Second contribution to a knowledge of the Miocene Fauna of Oregon."

The paper for the Magellanic premium being called up, and no report from the Board of Officers presented, a special meeting of the Board was ordered; and on motion of Mr. Briggs, it was resolved that a Committee of five be appointed by the Chair for considering and reporting upon the value of the claim. The Chair appointed Mr. Briggs, Prof. Chase, Prof. Kendall, Prof. E. H. Houston, and Mr. Coleman Sellers.

The Treasurer's annual report was read and referred to the Finance Committee.

Pending nominations Nos. 885 to 889, and new nominations 890 to 892, were read.

And the meeting was adjourned.